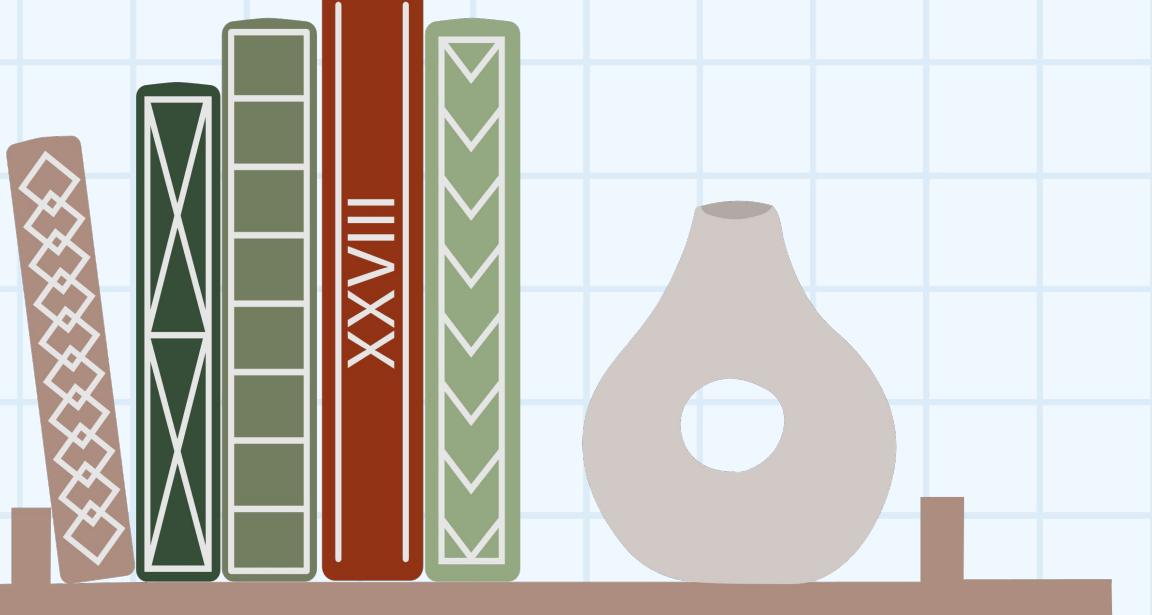




BS./BSC.IN

Applied AI and Data Science

Algorithmic Thinking & its Applications



Computational Thinking

- Using special thinking patterns and processes to pose and solve problems or prepare programs for computations.
- Simply put, it is a set of skills that help to set up a problem in such a way that a computer can help you solve it.



Picture credit: www.computationalthinkers.com/product/computationalthinking/

Four pillars of Computational Thinking

“

Breaking a problem down into smaller, more manageable parts.

Decomposition

“ “

Finding similarities between items as a way of gaining extra information.

Pattern matching

“

Ignoring certain details in order to come up with a solution that works for a more general problem.

Abstraction

Controlling a process by automatic means, reducing human intervention to a minimum.

**Algorithm
(Automation)**

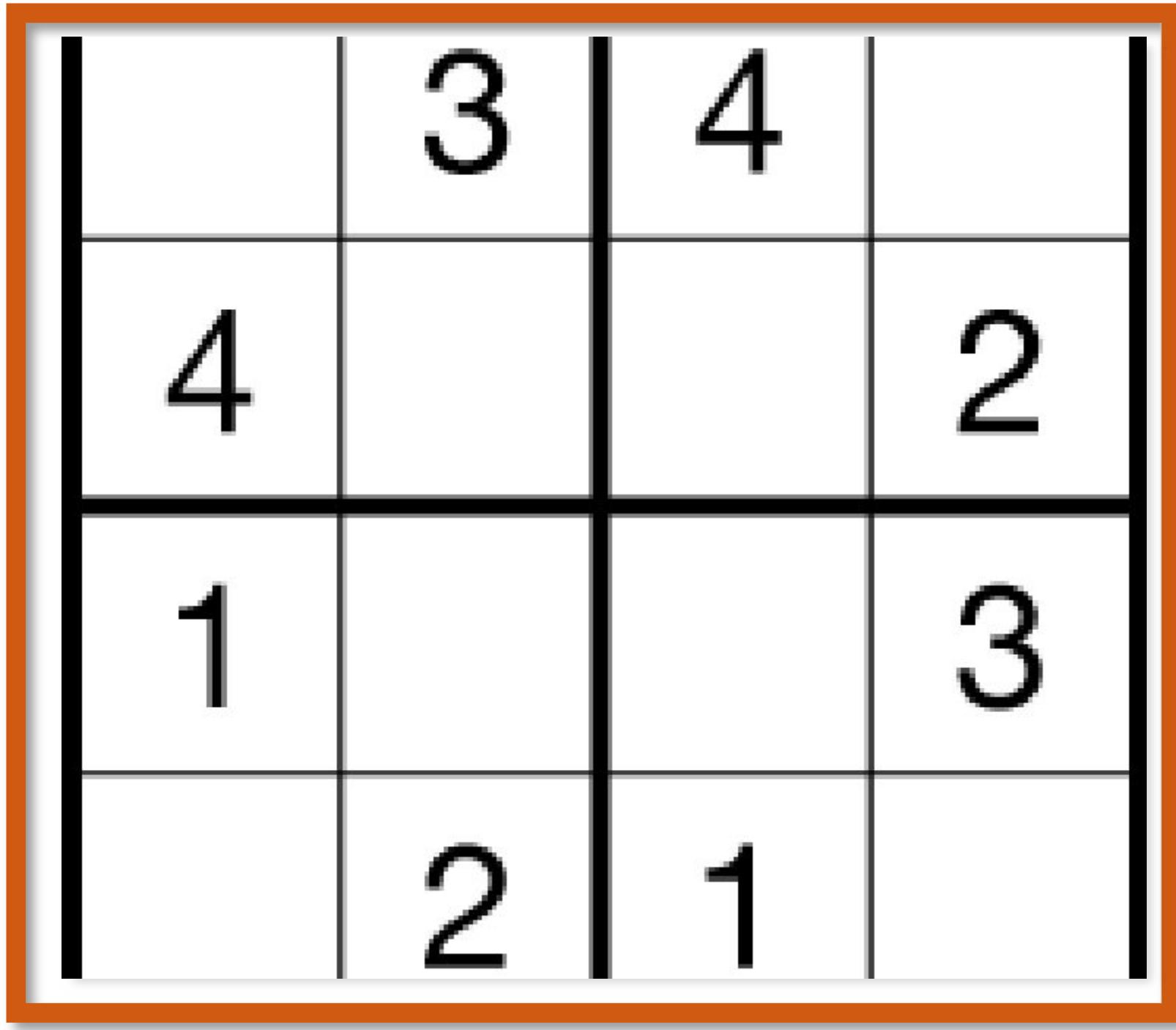
” ”

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Activity 1. Solve Sudoku

Decomposition

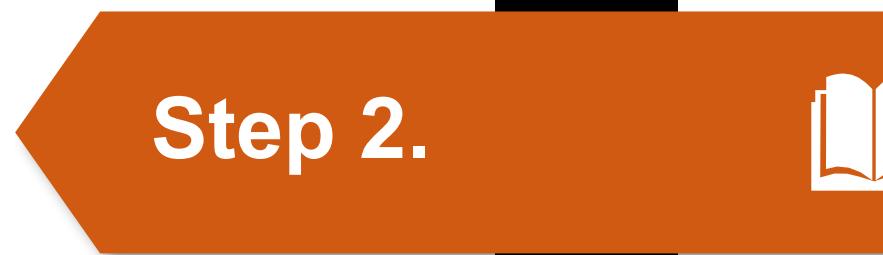
	3	4	
4			2
1			3
2	1		

Work on upper-right region (2)

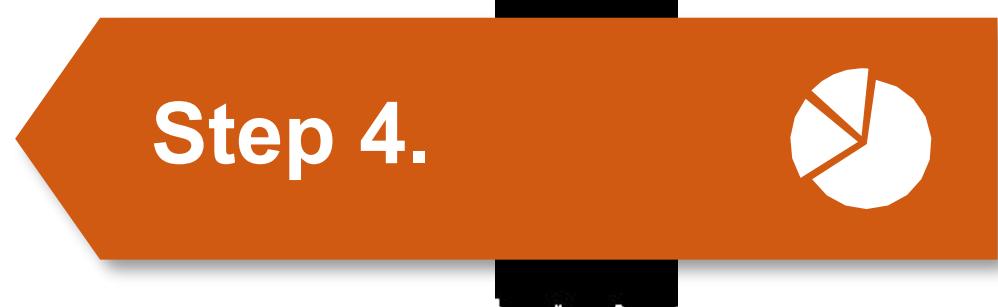
Work on lower-right region (4)



Work on upper-left region (1)



Work on lower-left region (3)



For Region 1

	3	4	
4			2
1			3
2	1		

If there is only one number missing from all three sets, that number goes to row 1 and column 1 in region 1.

That would be 2.

Look at the numbers that are missing in column 1 of the puzzle.

That would be 2 and 3.



Step 1.

Step 2.



Step 3.

Step 4.



Step 5.

Look at the numbers that are missing in row 1 of the puzzle.

That would be 1, 2.

Look at the numbers missing in region 1.

That would be 1, 2.

If there is a second number missing from all three sets, continue to the next cell and come back when you have more information.



For Region 2

	3	4	
4			2
1			3
2	1		

If there is only one number missing from all three sets, that number goes to row 2 and column 3 regaion 2.

That would be 3.

Look at the numbers that are missing in column 3 of the puzzle

That would be 2 and 3.



Step 1.

Step 2.



Step 3.

Step 4.



Step 5.

Look at the numbers that are missing in row 2 of the puzzle.

That would be 1, 3.

Look at the numbers missing in region 2.

That would be 1, 3.

If there is a second number missing from all three sets, continue to the next cell and come back when you have more information.



Pattern Matching



Step 1.

Look at the numbers
that are missing in
row 1.

That would be 1, 2.

For region 1



Step 1.

Look at the numbers
that are missing in
row 2.

That would be 1, 3.

For region 2



Abstraction

	3	4	
4			2
1			3
2	1		

If there is only one number missing from all three sets, that number goes to row X and column Y in region N.

That would be ...

Look at the numbers that are missing in column Y of the puzzle.

That would be ...



Step 1.

Step 2.



Step 3.

Step 4.



Step 5.

Look at the numbers that are missing in row X in the puzzle.

That would be ...

Look at the numbers missing in region N.

That would be 1, 3.

If there is a second number missing from all three sets, continue to the next cell and come back when you have more information.



Quiz

- What is an example of thinking computationally?
 - Planning out your route when going to meet a friend
 - When going to meet a friend, wandering around until you find them
 - When going to meet a friend, asking a parent to plan your route for you
- Which of the following is **NOT** an example of computational thinking?
 - Flipping a coin to decide what to do next
 - Considering the different options carefully before deciding upon the best one
 - Discussing with your friends how much time and money you have before choosing from a shortlist of places

Quiz-Answers

- What is an example of thinking computationally?
 - Planning out your route when going to meet a friend
 - When going to meet a friend, wandering around until you find them
 - When going to meet a friend, asking a parent to plan your route for you
- Which of the following is **NOT** an example of computational thinking?
 - Flipping a coin to decide what to do next
 - Considering the different options carefully before deciding upon the best one
 - Discussing with your friends how much time and money you have before choosing from a shortlist of places

Decomposition



“Journey of a thousand miles begins with a single step.”

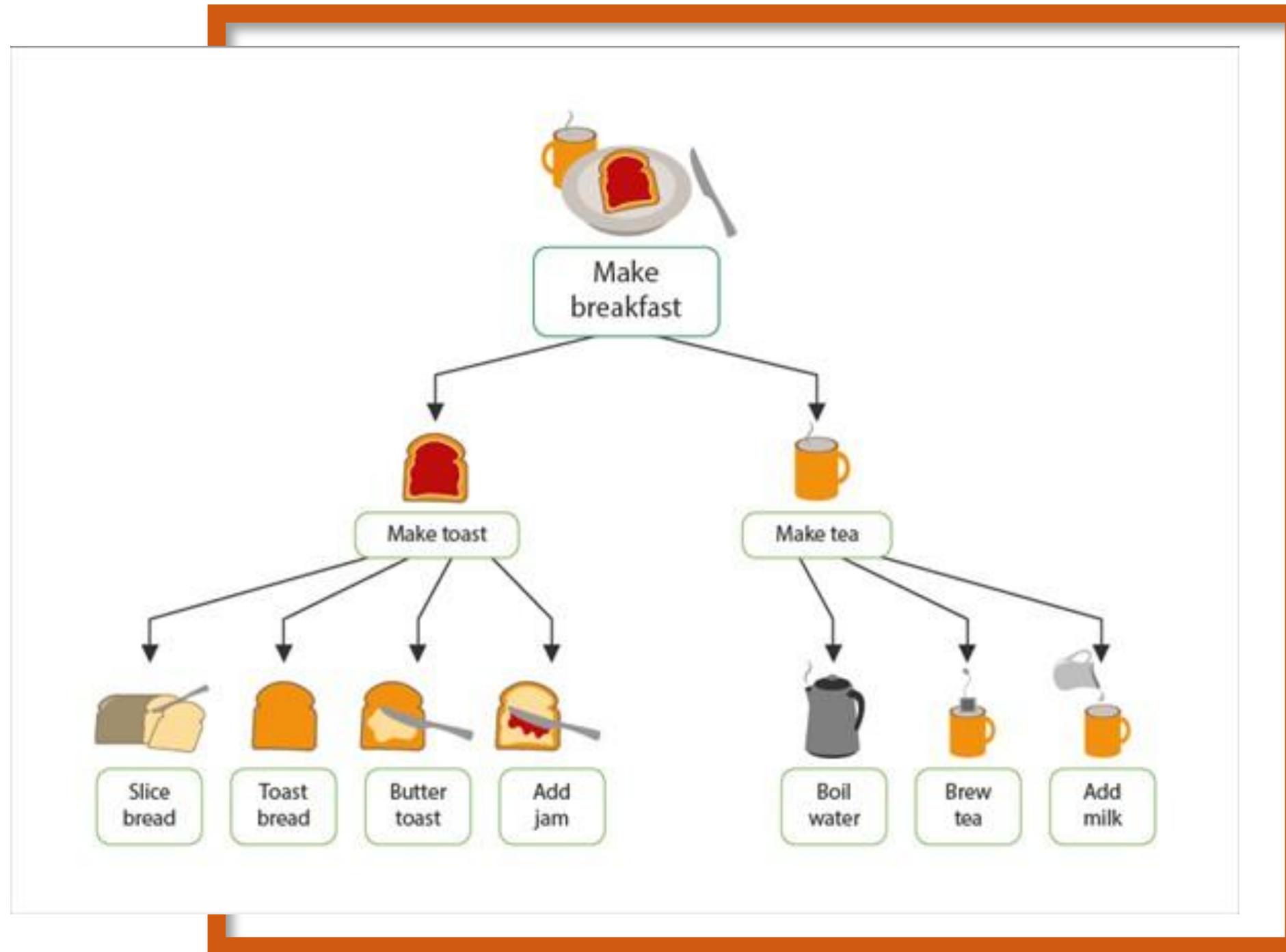
Lao Tzu

“When eating an elephant, take one bite at a time”

Creighton Abrams

Decomposition

In computing, decomposition is the process of breaking down a task into smaller, more-manageable parts.



Pattern Recognition (Matching)



Patterns are everywhere. By identifying patterns, we can create rules and solve more-general problems.

Abstraction

Caterpillar class Timetable	Monday	Tuesday	Wednesday	Thursday	Friday
8:50 to 9:00	Registration	Registration	Registration	Registration	Registration
9:00 to 10:00	English	English	English	English	English
10:00 to 10:20	Playtime	Playtime	Playtime	Playtime	Playtime
10:20 to 10:30	Class time	Class time	Class time	Class time	Class time
10:30 to 11:30	Maths	Maths	Maths	Maths	Maths
11:30 to 12:00	Phonics	Phonics	Phonics	Phonics	Phonics
12:00 to 1:00	Lunchtime	Lunchtime	Lunchtime	Lunchtime	Lunchtime
1:00 to 2:15	Topic	PE (small hall)	PE (large hall)	PPA subjects	Topic
2:15 to 3:15	Topic	Singing Assembly	Topic	PPA subjects	School Assembly

- The practice of ignoring certain details in order to come up with a solution that works for a more general problem.
- It is a way of letting go of details to make a process easier.

Algorithm (Automation)



- An algorithm is a sequence of instructions or a set of rules to get something done.
- Algorithms are written for a human, rather than for a computer to understand. In this way, algorithms differ from programs.

Problem-solving Process



- Problem analysis
- Alternative consideration
- Choosing an approach
- Problem decomposition
- Algorithm development
- Algorithm correctness
- Algorithm efficiency
- Reflection

Algorithm example

Find how many digits are there in a number?

Can we find sum of the digits?

Can we reverse a number?

Multiply by 10 and the number will move one place to the left

Thousands	Hundreds	Tens	Units
		1	5

Thousands	Hundreds	Tens	Units
	1	5	0



Thank you

